REMARKS

Claims 19-24, 27-34, 37-49, 51-60, 63-93, and 105-108 are pending in this application. Claims 19-24, 27-34, 37-42, 48, 49, 51-59, 63, 67, 70, 76, 77, 78, 88, 92, and 107 have been changed and claims 1-18, 25, 26, 35, 36, 50, 61, 62, and 94-104 have been cancelled by this Amendment.

The Examiner rejected claims 1 and 27 under 35 U.S.C. §112, second paragraph. Applicant has amended these claims as set forth above, and respectfully requests that the rejection be withdrawn.

The Examiner rejected claims 1 and 2 under 35 U.S.C. §102(b) as being anticipated by Affinito et al. Claims 1 and 2 are believed patentable, but have been cancelled by this amendment to expedite prosecution. Applicant respectfully requests that the rejection under §102(b) be withdrawn.

The Examiner rejected claims 1-3, 5, 7-12, 94-96, 98-100, 105, and 107 under 35 U.S.C. §102(e) as being anticipated by Hollis Jr. et al. (U.S. Patent No. 5,146,566) ("Hollis"). Claims 1-3, 5, 7-12, 94-96, and 98-100 are believed patentable, but have been cancelled by this amendment to expedite prosecution.

Claim 105 recites an interface device for controlling a position of a graphical cursor and providing tactile feedback in accordance with displayed interactions between a cursor and other graphical objects. The device includes a physical object, at least one sensor, and an actuator that applies tactile feedback to the user's hand, where the actuator is controlled to apply bi-stable tactile feedback to the user that indicates when the cursor moves from one menu element to another of a displayed menu. Applicant claims "bi-stable" tactile feedback for menu elements. This causes the cursor to be biased toward the kinesthetically-stable menu elements, thereby aiding the user's selection of the menu elements. Hollis does not disclose or suggest providing any tactile feedback to menu elements, and certainly does not disclose or suggest providing any bi-stable tactile feedback between menu elements of a displayed menu to indicate and/or assist user selections. Applicant therefore believes that claim 105 is patentable over Hollis. Claims 106-108 are dependent from claim 105 and are patentable for at least the same reasons as claim 105 and for additional reasons. For example, claim 107 recites that the actuator is physically coupled to a physical member moved with respect to said physical object to contact and apply pressure to the user's hand. Hollis discloses no member that moves with respect to the handle or other object and apply pressure to a user's hand.

In view of the foregoing, Applicant believes that claims 105 and 107 are patentable over Hollis, and respectfully requests that the rejection under §102 be withdrawn.

The Examiner rejected claims 4, 6, 13-93, 97, 101-104, 106, and 108 under 35 U.S.C. §103(a) as being anticipated by Hollis Jr. et al. (U.S. Patent No. 5,146,566) ("Hollis"). Applicant has amended some of the claims to clarify the invention. Claims 4-6, 13-18, 50, 61-62, and 94-104 are believed patentable, but have been cancelled by this amendment to expedite prosecution.

Claim 19 recites an interface device for enabling a user to spatially navigate a displayed graphical menu with a displayed graphical pointer and provides tactile feedback to the user when the graphical pointer is moved from one menu element to the next. An embedded microprocessor sends handle movement data and button data to a host computer such that the host can update displayed pointer locatons with respect to the graphical menu; receives desired force values from the host, where the force values are correlated with particular pointer locations displayed by the host; and controls the actuator in accordance with the received force values to provide tactile sensations correlated with the location of the graphical pointer displayed in the menu. These features are disclosed in the specification in, inter alia, col. 8, lines 47-65 and col. 9, lines 6-14.

In contrast, Hollis discloses an input/output device having a handle base, a flotor unit with coils, and a stator unit having magnets. The flotor unit and handle are levitated with magnetic forces. As described in col. 8, lines 29-61, and col. 9, line 65 to col. 10, line 29, the position of the flotor as read by sensors is sent to a host application program to update the program. The host program supplies a reference position (and orientation) to a digital signal processor (DSP) 620, and the DSP compares this reference position to the current actual position of the flotor. The error between these positions is determined by the DSP, and the DSP then calculates a total force based on this error and on stiffnesses that are supplied by the host computer. The DSP then controls the coils to output the calculated forces on the flotor.

This control scheme of Hollis does not disclose or suggest Applicant's device of claim 1. Claim 1 recites that the embedded microprocessor receives desired force values from the host computer, where the force values are correlated with particular pointer locations displayed by the host computer. Hollis does not disclose sending force values to the DSP on the device; rather, Hollis sends reference positions that indicate where the origin of a spring force is to be placed so that the DSP can calculate a spring force between that reference position and the current position. Hollis also sends stiffnesses from the host to the DSP which indicate the stiffness of the spring force determined by the DSP. This is not the same as sending force values as recited by Applicant, where the force values are correlated with particular pointer locations. The host has already determined the forces to be output at particular displayed locations within a menu, and sends force values to the embedded microprocessor to control the actuator to provide those

forces. Thus, the embedded microprocessor in claim 19 is providing a completely different control function than the device of Hollis.

Furthermore, claim 19 recites that a displayed graphical pointer is used to navigate a displayed graphical menu, and that tactile feedback provides feedback when the pointer is moved from one menu element to the next. Hollis does not disclose or suggest any displayed menus having menu elements, nor discloses providing tactile feedback when a pointer is moved between different menu elements. Accordingly, claim 1 is believed patentable over Hollis.

Claims 20-24, 27-34, and 37-40 are dependent from claim 19 and are believed patentable for at least the same reasons as claim 19 and for additional reasons. For example, claim 21 recites that the handle is physically coupled to a support mechanism that is grounded and allows linear displacement between the handle and an origin. Hollis does not disclose a support mechanism; rather, the rotor assembly in Hollis is levitated by magnetic forces, not physically coupled to a grounded support mechanism. Claims 27-28 recite that a memory of the device stores values representative of the locations of images displayed by the host; Hollis discloses no such local memory storage of image locations. Claim 31 recites that the microprocessor receives display information from the host computer; Hollis only discloses providing reference positions and stiffnesses from the host to the device. Claims 33-34 recite an attractive force, which is not disclosed or suggested by Hollis. The Examiner stated that it would have been obvious that the generated forces of Hollis could have been any type of forces since it merely depends on the type of application running; however, Hollis does not disclose any attractive forces, despite mentioning other types of forces, so that it is believed that attractive forces are not obvious. Claim 39 recites that the microprocessor receives code from a host computer and executes the code, which is not disclosed or suggested by Hollis.

Claim 41 recites a device including a handle, actuator, button, and embedded microcontroller that sends handle movement data and button data to a host computer so that the host can update a displayed pointer location in a graphical environment, receives a force value from the host computer that is correlated with the updated displayed pointer location, and controls an actuator in accordance with the received force value so as to provide the tactile sensation to the user correlated with the location of the pointer. Similar to the explanation of claim 19 above, claim 41 is patentable over Hollis since Hollis does not disclose or suggest an embedded microcontroller that receives a force value from the host computer, the force value correlated with the updated displayed pointer location, and that controls an actuator in accordance with the received force value to provide a tactile sensation correlated with pointer location. Hollis discloses sending a reference position and stiffness to a DSP to allow the DSP to determine output forces; a force value that the host has determined is not sent to the device. Claim 41 is therefore believed patentable over Hollis. Claims 42-49 and 51-58 are dependent from claim 41 and are patentable over Hollis for at least the same reasons as claim 41 and for

additional reasons. For example, claims 42-47 recite a memory that stores location information which corresponds to image data from a computer display; claims 49 and 52 recite planar and/or linear degrees of freedom; claim 55 recites a tactile sensation corresponding with interaction of a graphical menu and menu items; claim 56 recites that the tactile sensation is applied to correspond with the pointer interacting with a displayed button; and claim 58 recites interaction with a displayed icon, none of which are disclosed or suggested by Hollis.

Claim 59 recites an interface device including a physical object, at least one actuator, a sensor, a user-adjustable switch, and a microprocessor local to the interface apparatus. The micoprocessor receives, from the host, force values correlated with particular locations of the pointer, executes a process, and provides a force control signal to an actuator to impart forces in accordance with the received force values to provide tactile sensations correlated with pointer location. Similar to the explanation set forth above for claim 41, claim 59 recites receiving force values with a microprocessor from a host, which is not disclosed or suggested by Hollis. Claim 59 is therefore believed patentable over Hollis. Claim 60 is dependent from claim 59 and is patentable over Hollis for at least the same reasons as claim 59. In addition, claim 60 recites a displayed graphical menu and the selection of menu elements therefrom, which is not disclosed or suggested by Hollis.

Claim 63 recites a method for controlling a force feedback interface device including sending a position signal to a host computer, receiving a force value from the host with a local microprocessor, the force value being correlated with cursor location, and controlling one or more actuators in accordance with the received force value to provide a tactile sensation to the user. As explained above, Hollis does not disclose or suggest providing a force value to the local microprocessor on the device, so that claim 63 is believed patentable over Hollis. Claims 64-66 are dependent from claim 63 and are patentable for at least the same reasons as claim 63. In addition, for example, claim 66 recites graphical objects such as an icon and menu not disclosed by Hollis.

Claim 67 recites a method for providing force feedback including receiving on a local microprocessor a locative signal representing a position of a handle, associating elements in a graphical user interface with forces affecting the handle based on the location of a cursor, and receiving on the microprocessor the location of at least one element displayed by the display device in the graphical user interface, and storing the location in local memory. Hollis does not disclose or suggest associating elements in a graphical user interface with forces based on the location of the cursor with respect to the elements, and receiving on the microprocessor the location of at least one element and storing that location in local memory. Hollis discloses sending a reference position or a stiffness for a spring force to a DSP, which is not a location of a displayed element, and nowhere suggests providing locations of graphical elements within a GUI to a microprocessor. One advantage of the invention of claim 67 is that the local microprocessor

can locally check the locations of graphical elements and output appropriate forces when the cursor interacts with the elements, which is not even addressed in Hollis. Applicant therefore believes claim 67 is patentable over Hollis. Claims 68-70 are dependent from claim 67 and believed patentable for at least the same reasons as claim 67 and for additional reasons. For example, claim 68 recites that the element is an icon and the force is an attractive force; claim 69 recites an icon and an impeding force; and claim 70 recites a vertical menu including menu items, none of which are disclosed or suggested by Hollis.

Claim 71 recites a method for providing force feedback including receiving an indication of movement of a physical object, moving a cursor within a graphical user interface, and using an actuator to apply a force in a degree of freedom of the physical object, the force being applied when the cursor is positioned within a preselected distance of a graphical object. Hollis nowhere discloses or suggests applying a force when a cursor is within a preselected distance of a graphical object; Hollis only mentions outputting forces based on transitioning a pointer from one window to another, not outputting a force when a cursor is within a preselected distance of a graphical object. Claims 72-75 are dependent from claim 71 and are believed patentable over Hollis for at least the same reasons as claim 71 and for additional reasons. For example, claim 72 recites that the graphical object is an icon and the force is an attractive force drawing the cursor toward the icon; claim 73 recites that the force resists overshoot of the cursor when the user selects the object; claim 74 recites a viscous drag force when the object is moved; and claim 75 recites that the object is the thumb of a scroll bar, all of which are not disclosed or suggested by Hollis.

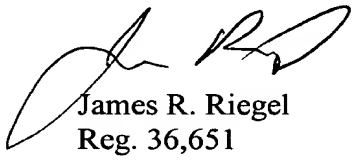
Claim 76 recites an interface device including a physical object, one or more sensors producing a locative signal indicative of the position of the physical object in two planar degrees of freedom, a z-axis actuator applying a force to the user only along a z-axis degree of freedom, and a microprocessor separate from and in communication with the host computer and controlling current through the portion of the actuator in accordance with force information. In contrast, Hollis discloses a device having six forcer elements on the rotor and several magnets on the stator, as shown in Figs. 1 and 4. Apparently, all of the six forcer elements must be energized and exert force on the flotor for the flotor to levitate. Thus, none of the forcer elements is dedicated to a particular direction or axis or degree of freedom; multiple forcer elements are energized to provide any particular directional force on the rotor and handle. In contrast, Applicant recites a z-axis actuator that applies force only along a z-axis degree of freedom different from planar degrees of freedom. Hollis does not disclose an actuator that only outputs forces in a z-axis degree of freedom, and thus claim 76 is believed patentable over Hollis. Claims 77-93 are dependent from claim 76 and are believed patentable over Hollis for at least the same reasons as claim 76. In addition, claim 77 recites that the planar workspace are x and y axes and that the z-axis degree of freedom is substantially perpendicular to the x and y axes. Hollis does not disclose a z-axis actuator that applies a force substantially perpendicular to a

planar workspace of a device. For example, Hollis discloses a hexagonal arrangement of forcer elements in Fig. 1, none of which is dedicated to applying a force in the perpendicular z-axis directions; instead, multiple force elements must work together to provide any z-axis forces. In addition, for example, claim 78 recites that the physical object is a mouse; claim 85 recites that the actuator indicates when the cursor moves from one displayed menu element to another displayed menu element; claim 91 recites local memory that stores values representative of locations of displayed images; and claims 92 and 93 recite a physical tactile element that applies pressure to the user's hand, none of which are disclosed or suggested by Hollis.

In view of the foregoing, Applicant believes that claims 19-24, 27-34, 37-49, 51-60, 63-93, 106 and 108 are patentable over Hollis, and respectfully requests that the rejection under 103 be withdrawn.

In view of the foregoing, Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,



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